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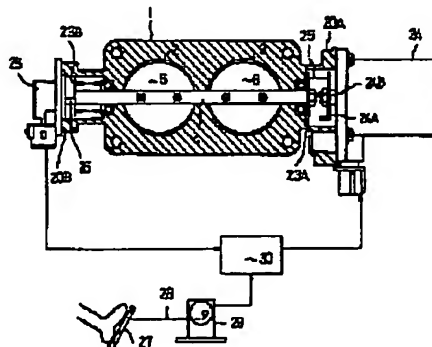
(54) **INTAKE AIR QUANTITY CONTROL DEVICE FOR
INTERNAL COMBUSTION ENGINE**

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(57) Abstract

PURPOSE: To reduce the load torque to be applied to a throttle valve so as to lower the rated output of a motor, and to downsize a motor.

CONSTITUTION: An intake air passage passing through a throttle body 1 is formed of a first intake air passage 2 and a second intake air passage 3, and single throttle valve shaft 4, which is supported by the throttle body 1 freely to be turned, crosses the first intake air passage 2 and the second intake air passage 3. A first throttle valve 5 for controlling opening of the first intake air passage 2 and a second throttle valve 6 for controlling opening of the second intake air passage 3 are respectively fitted to the throttle valve shaft 4. Rotation of a motor 24 to be rotated in response to the output signal from an ECU 30 is given to the throttle valve shaft 4, and the first throttle valve 5 controls opening of the first intake air passage 2 and the second throttle valve 6 controls opening of the second intake air passage 3 with the rotation of the throttle valve shaft 4.



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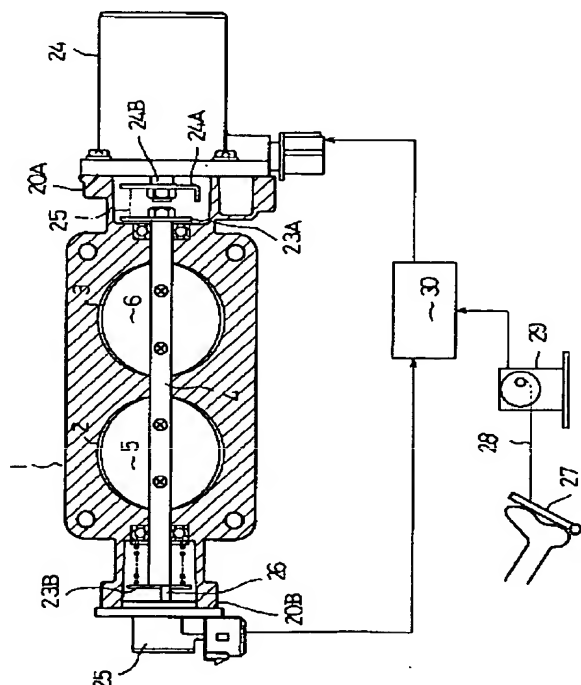
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(54)【発明の名称】 内燃機関における吸気量制御装置

(57)【要約】

【目的】 絞り弁に作用する負荷トルクを低減して、モータの定格出力を下げ、モータを小型化する。

【構成】 スロットルボデー1を貫通する吸気路は、第1吸気路2と、第2吸気路3とにより形成され、スロットルボデー1に回転自在に支承される単一の絞り弁軸4は、第1吸気路2と第2吸気路3とを横断する。第1吸気路2の開口を制御する第1絞り弁5及び第2吸気路3の開口を制御する第2絞り弁6はそれぞれ絞り弁軸4に取着される。E C U 30からの出力信号に応じて回転するモータ24の回転は絞り弁軸4に付与され、絞り弁軸4の回転によって第1絞り弁5は第1吸気路2の開口を制御し、第2絞り弁6は第2吸気路3の開口を制御する。



English Translation of

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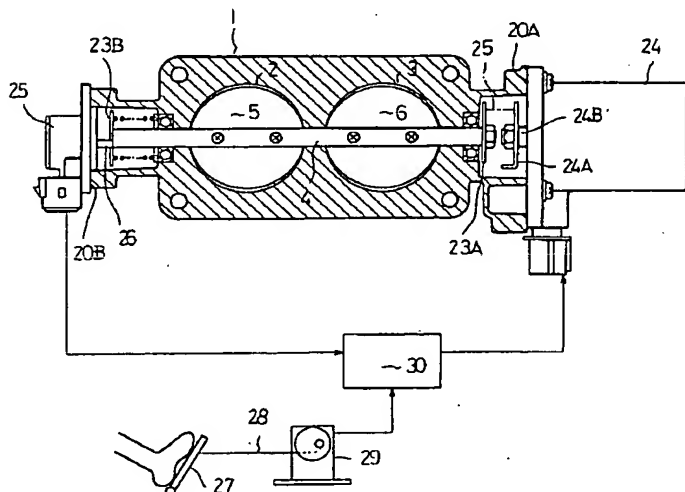
Inventor: OSAO NORIAKI, TORIKAI MINEO

Applicant: KEIHIN SEIKI MFG CO LTD

[Abstract]

PURPOSE: To reduce the load torque to be applied to a throttle valve so as to lower the rated output of a motor, and to downsize a motor.

CONSTITUTION: An intake air passage passing through a throttle body 1 is formed of a first intake air passage 2 and a second intake air passage 3, and single throttle valve shaft 4, which is supported by the throttle body 1 freely to be turned, crosses the first intake air passage 2 and the second intake air passage 3. A first throttle valve 5 for controlling opening of the first intake air passage 2 and a second throttle valve 6 for controlling opening of the second intake air passage 3 are respectively fitted to the throttle valve shaft 4. Rotation of a motor 24 to be rotated in response to the output signal from an ECU 30 is given to the throttle valve shaft 4, and the first throttle valve 5 controls opening of the first intake air passage 2 and the second throttle valve 6 controls opening of the second intake air passage 3 with the rotation of the throttle valve shaft 4.



[Claim(s)]

[Claim 1] Closing motion control of the inhalation-of-air way which penetrates the throttle body is carried out in the throttle valve attached in the throttle valve shaft bearing of the rotation of was made free to the throttle body. In the inspired-air-volume control unit in the internal combustion engine with which the motor which gives turning effort to a throttle valve shaft according to the electrical signal outputted to a throttle valve shaft from an electro nick control unit is arranged, and rotation of a motor is given to a throttle valve shaft Bearing of the rotation of the single throttle valve shaft 4 which crosses the inside of the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 while the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 penetrate and are drilled is made free to the throttle body 1, and it is arranged. The inspired-air-volume control unit in the internal combustion engine characterized by giving rotation of a motor 24 to the throttle valve shaft 4 while the 1st throttle valve 5 which opens and closes the 1st inhalation-of-air way 2, and the 2nd throttle valve 6 which open and close the 2nd inhalation-of-air way 3 were attached in this throttle valve shaft 4.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to what operates the throttle valve which especially controls inspired air volume by the motor driven electrically about the inspired-air-volume control unit which controls the inspired air volume supplied towards an internal combustion engine's combustion chamber by the throttle valve arranged in the inhalation-of-air way of the throttle body.

[0002]

[Description of the Prior Art] Drawing 4 and drawing 5 explain the inspired-air-volume control unit in the conventional internal combustion engine. Important section drawing of longitudinal section of an inspired-air-volume control unit [in / in drawing 4 / the conventional internal combustion engine] and drawing 5 are the schematic diagrams showing the condition of constructing the inspired-air-volume control unit shown in drawing 4 to the internal combustion engine. 20 is the throttle body drilled by the single inhalation-of-air way 21 penetrating the interior, into the inhalation-of-air way 21, the throttle valve shaft 22 crosses, and is arranged and bearing of the rotation of the both ends of this throttle valve shaft 22 is made free to the throttle body 20. 23 is a throttle valve which opens and closes the inhalation-of-air way 21, and is attached in the throttle valve shaft 22. That is, when the throttle valve shaft 22 rotates, closing motion control of the inhalation-of-air way 21 is carried out by the throttle valve 23. 24 is a motor arranged on right-hand side edge 20A of the throttle body 20, and rotation of this motor 24 is given to 1st throttle-lever 23A arranged at the right end of the throttle valve shaft 22 through a means of communication 25 from motor lever 24A. On the other hand, on left-hand side edge 20B of the throttle body 20, the throttle valve opening sensor 25 for a monitor is arranged, and rotation of the throttle valve shaft 22 is given to this throttle valve opening sensor 25 for a monitor through 2nd throttle-lever 23B and a means of communication 26. This throttle valve opening sensor 25 for a monitor outputs an electrical signal to the electro nick control unit which detects and mentions later the opening location condition of the throttle valve 23 driven by the motor 24, and an acceleration-and-deceleration condition, and checks whether the throttle valve 23 has operated normally.

[0003] And as following, an electrical signal is inputted and a rotation drive is carried out at a motor 24. 27 is an accelerator pedal (or accelerator grip) operated by an operator's volition, the control input of this accelerator pedal 27 is mechanically inputted into the accelerator pedal sensor 29 (this is an angle sensor, a stroke sensor, etc.) through the means of communication 28, such as a wire and a link, this control input is changed into an electrical signal by the accelerator pedal sensor 29, and this electrical signal is outputted towards the electro nick control unit 30 (it is called Following ECU). And if the electrical signal from this accelerator pedal sensor 29 is inputted into ECU30, it passes along an input circuit, and an analog signal will be inputted into a microcomputer directly [a digital signal], after digital conversion is carried out by the A/D converter.

And a microcomputer carries out data processing of this input signal, and outputs the electrical signal according to actuation of an accelerator pedal 27 to a motor 24 through an output circuit.

[0004] According to the above, a motor 24 gives the rotation according to actuation of an accelerator pedal 29 to 1st throttle-lever 23A through motor lever 24A and a means of communication 25, and a throttle valve 23 can obtain the throttle valve opening according to actuation of an accelerator pedal 29, and is supplied to an internal combustion engine's combustion chamber by this through the inlet pipe which the air controlled by the throttle valve 23 mentions later. In addition, a motor 24 carries out a rotation drive normally with the electrical signal outputted from ECU30, and the throttle valve opening sensor 25 for a monitor mentioned above makes the duty which supervises that the throttle valve shaft 22 and the throttle valve 23 operated normally (rotation).

[0005] And the throttle body 20 containing these motors 24 is built into an internal combustion engine as following. If drawing 5 explains, 31 is an internal combustion engine, the suction port 35 which stands in a row in a combustion chamber 34, and the exhaust air port 36 will be drilled by the cylinder head 33 combined with the top face of a cylinder block 32, and the inlet pipe 38 equipped with the fuel injection valve 37 will be connected to it at the suction port 35 which carries out opening to the side face of the cylinder head 33. And the throttle body 20 which equipped the upstream of an inlet pipe 38 with the motor 24 is connected, and an air cleaner 39 is further connected to the upstream of the throttle body 20. Therefore, the amount is controlled by the throttle valve 23, and the air which flows from an air cleaner 39 is supplied into a combustion chamber 34 through an inlet pipe 38 and a suction port 35. When the fuel in a fuel tank 40 is pressurized by the fuel injection valve 37 with a fuel pump 41, and is supplied to it through the fuel distribution tube 42 and a fuel injection valve 37, on the other hand, carries out opening of the nozzle hole to it with the valve-opening signal from ECU30, injection supply of the fuel of the pressurized request is carried out into a combustion chamber 34 through an inlet pipe 38 and a suction port 35.

[0006]

[Problem(s) to be Solved by the Invention] According to the inspired air-volume control unit in this conventional internal combustion engine, it has the following technical problems. To a throttle valve 23, it works at the time of sudden acceleration operation of the engine with which a throttle valve 23 opens the inhalation-of-air way 21 continuously, or ***** operation, the torque, i.e., the load torque, by the side of the closed direction. In case, as for this load torque, the flowing inhalation-of-air flow flows down the inside of the inhalation-of-air way 21 from the upstream of a throttle valve 23 to the downstream, generating, since the surface pressure distribution in the top face of a throttle valve 23 becomes an ununiformity by change of the projected area formed between the top faces of a throttle valve 23 and the inhalation-of-air ways 21 by the throttle valve 23 is known. Moreover, what the load torque increases the relation between the path of the

inhalation of air way 21 and load torque for as the path of the inhalation of air way 21 becomes large (it becomes large) is known. the time of sudden open [which will turn a throttle valve 23 to full open, and will open it quickly within 1 second from a close by-pass bulb completely by 58mm of diameters of the inhalation of air way 21 where the negative pressure of -700mmHg is applied in the inhalation of air way 21 of the downstream of a throttle valve 23 at the time of the close by-pass bulb completely of a throttle valve 23 if a concrete example is explained with drawing 2] .. setting .. the middle opening near 55-degree disconnection of a throttle valve 23 .. 3 .. the load torque of Kgf(s) and Cm occurs. (Drawing 2 is shown by the alternate long and short dash line.) the time of **** which opens a throttle valve 23 gradually towards full open under the same conditions as the above on the other hand over 10 seconds or more from a close by-pass bulb completely .. setting .. the middle opening near 55-degree disconnection of a throttle valve 23 .. 1.1 .. the load torque of Kgf(s) and Cm occurs. (Drawing 2 is shown by the dotted line.) And it gains in power consumption that big load torque acts to a throttle valve like ****, and it is not desirable while it is necessary to enlarge need torque of a motor, and a motor is enlarged according to this. Among these, according to a motor being enlarged, while attachment into the tooth space where it was restricted in the bonnet like the automobile, and hold become difficult, weight increases and it is not desirable. Moreover, it is not desirable that power consumption increases, if it is in some electric capacity is mostly defined and cannot increase the electric capacity without a limit like an automobile.

[0007] It is in lowering and having the rated output of a motor and miniaturizing a motor by having made this invention in view of said technical problem, and reducing the load torque which acts on a throttle valve.

[0008]

[Means for Solving the Problem] According to this invention, the inhalation of air way where said technical problem penetrates the throttle body Closing motion control is carried out in the throttle valve attached in the throttle valve shaft bearing of the rotation of was made free to the throttle body. In the inspired air volume control unit in the internal combustion engine with which the motor which gives turning effort to a throttle valve shaft according to the electrical signal outputted to a throttle valve shaft from an electro nick control unit is arranged, and rotation of a motor is given to a throttle valve shaft While the 1st inhalation of air way and the 2nd inhalation of air way penetrate on the throttle body and are drilled, the 1st inhalation of air way, Bearing of the rotation of the single throttle valve shaft which crosses the inside of the 2nd inhalation of air way is made free, and it is arranged, and while the 1st throttle valve which opens and closes the 1st inhalation of air way, and the 2nd throttle valve which open and close the 2nd inhalation of air way are attached in this throttle valve shaft, it is attained by having given rotation of a motor to the throttle valve shaft.

[0009]

[Function] The inspired air volume which an internal combustion engine needs is

guaranteed with the totaled inspired air volume of the inspired air volume supplied from the 1st inhalation-of-air way, and the inspired air volume supplied from the 2nd inhalation-of-air way. On the other hand, each inhalation-of-air **** of the 1st inhalation-of-air way and the 2nd inhalation-of-air way can be made into a minor diameter, more nearly respectively than the conventional inhalation-of-air **** which has a single inhalation-of-air way, and according to this, it can reduce both the load torque which joins the 1st throttle valve of the 1st inhalation-of-air way, and the load torque which joins the 2nd throttle valve of the 2nd inhalation-of-air way. Therefore, the load torque by which these were totaled is reduced, and it can have it, and it can lower the rated output of a motor.

[0010]

[Example] Hereafter, drawing 1 explains one example of the inspired-air-volume control unit in the internal combustion engine which becomes this invention. In addition, the same sign is used about a part for the same structured division as drawing 4. 1 is the throttle body with which the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 were drilled by penetrating, and the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 are formed in parallel. 4 is a single throttle valve shaft, the core of the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 is crossed, and bearing of the rotation of the both ends is made free to the throttle body 1. 5 is the 1st throttle valve which controls opening of the 1st inhalation-of-air way 2, it is attached in the throttle valve shaft 4, and the 2nd throttle valve 6 which controls opening of the 2nd inhalation-of-air way 3 is also attached in this throttle valve shaft 4. Therefore, if the throttle valve shaft 4 rotates, it will rotate synchronous, and the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 will be opened [the 1st throttle valve 5 and the 2nd throttle valve 6] and closed. And motor lever 24A attached in output-shaft 24B of the motor 24 arranged on 1st throttle-lever 23A arranged at the right end of the throttle valve shaft 4 and right-hand side edge 20A of the throttle body 1 is mechanically connected by the means of communication 25. This means of communication 25 just transmits the turning effort by the side of one to rotation of the side else like linkage. Moreover, rotation of the throttle valve shaft 4 is given to the throttle valve opening sensor 25 for a monitor arranged on left-hand side edge 20B of the throttle body 1 through 2nd throttle-lever 23B arranged at the left end of the throttle valve shaft 4, and a means of communication 26.

[0011] Next, the operation is explained. If an operator breaks in and operates an accelerator pedal 27 by that volition, this control input will be mechanically inputted into the accelerator pedal sensor 29 through a means of communication 28, this control input will be changed into an electrical signal by the accelerator pedal sensor 29, and this electrical signal will be outputted towards ECU30. And if it is in ECU30, the electrical signal according to actuation of an accelerator pedal 27 is outputted to a motor 24 through an output circuit. According to the above, a motor 24 gives the rotation according

to actuation of an accelerator pedal 29 to throttle-lever 23A and the throttle valve shaft 4 through output-shaft 8A, the motor lever 9, and a means of communication 25. And if the throttle valve shaft 4 rotates in response to rotation of said motor 24, while the 1st throttle valve 5 carries out open control of the 1st inhalation-of-air way 2 according to the rotation, the 2nd throttle valve 6 will carry out open control of the 2nd inhalation-of-air way 3 according to the rotation. Therefore, while the inspired air volume controlled by the 1st throttle valve 5 from the 1st inhalation-of-air way 2 is supplied into a combustion chamber 34, the inspired air volume controlled by the 2nd throttle valve 6 from the 2nd inhalation-of-air way 3 is supplied into a combustion chamber 34. That is, in a combustion chamber 34, the totaled inspired air volume of the inspired air volume supplied from the 1st inhalation-of-air way 2 and the inspired air volume supplied from the 2nd inhalation-of-air way 3 is supplied.

[0012] Here, if it was in this invention, as mentioned above, the inhalation-of-air way was replaced with the conventional single inhalation-of-air way, and two inhalation-of-air ways of the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 were prepared. According to the above, the path of the 1st inhalation-of-air way 2 and the path of the 2nd inhalation-of-air way 3 can be made into a minor diameter as compared with the path of the conventional single inhalation-of-air way. That is, if it is in the thing of this invention using two inhalation-of-air ways in 58mm and the set-up thing about the path of the inhalation-of-air way when an example is raised and explained, and the conventional single inhalation-of-air way is used, the path of each inhalation-of-air way of the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 can be set up with 40mm. the time of this setup -- setting -- 58mm o'clock of diameters of an inhalation-of-air way -- setting -- the opening area -- 2,642mm² [when 40mm of two diameters of an inhalation-of-air way is used] it is -- the sum total of the opening area Although the opening area is decreasing about 5% with 2 (1,257mm² x2 piece =2,514mm²) by 2,514mm From the first, from the path of an inhalation-of-air way fully being set up with allowances to the full open inspired air volume which an internal combustion engine needs, reduction of a slight opening area does not pose a problem at all, and the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 which have the path of a 40mm inhalation-of-air way can be used.

[0013] On the other hand, the experimental result of the load torque of the throttle valve at the time of being set as the path of this 40mm inhalation-of-air way is shown in drawing 3 . The conditions in this experiment were the same as the conditions which experimented in drawing 2 , applied the negative pressure of -700mmHg in the inhalation-of-air way of the downstream of a throttle valve at the time of the close by-pass bulb completely of a throttle valve, attached it at the time of sudden open [which turns a throttle valve to full open from a close by-pass bulb completely in this condition, and it opens quickly within 1 second], and **** which opens a throttle valve gradually towards full open over 10 seconds or more from a close by-pass bulb completely, and were

performed. considering the above experimental result -- the time of sudden open [of a throttle valve] -- setting -- the middle opening near the 55-degree opening of a throttle valve -- 1.1 -- the load torque of Kgf(s) and Cm occurs. (Drawing 3 is shown by the alternate long and short dash line.) again -- the time of **** of a throttle valve -- setting -- the middle opening near the 55-degree opening of a throttle valve -- 0.4 -- the load torque of Kgf(s) and Cm occurs. (Drawing 3 is shown by the dotted line.) if it is in the thing of 40mm of diameters of an inhalation-of-air way, considering the above experimental result -- the time of sudden open [of a throttle valve] -- a maximum of 1.1 -- the load torque of Kgf and Cm occurs. if it was in this invention, since the 1st inhalation-of-air way 2 and the 2nd inhalation-of-air way 3 which have the path of a 40mm inhalation-of-air way were prepared -- the time of sudden open [of a throttle valve] -- setting -- the 1st throttle valve 5 -- a maximum of 1.1 -- the load torque of Kgf and Cm -- acting -- on the other hand -- the 2nd throttle valve 6 -- a maximum of 1.1 -- the load torque of Kgf and Cm acts. 2.2 [therefore,] by which those load torque was totaled by the throttle valve shaft 4 -- the load torque of Kgf(s) and Cm will act. the maximum load torque 3 which is generated in the conventional inspired-air-volume control unit using the single inhalation-of-air way which has the path of a 58mm inhalation-of-air way according to the above -- the maximum load torque generated in this invention as compared with Kgf and Cm -- 2.2 -- it can decrease with Kgf(s) and Cm.

[0014] Thus, according to having reduced the load torque which acts on a throttle valve, rotation actuation of the throttle valve shaft which contains a throttle valve also by lowering the rated output of a motor 24 is attained, and according to the above, while being able to attain the miniaturization of a motor, it becomes possible to save the consumed electric current of a motor.

[0015]

[Effect of the Invention] According to the inspired-air-volume control unit in the internal combustion engine which becomes this invention like the above Since the 1st throttle valve which carries out closing motion control of the 1st inhalation-of-air way, and the 2nd throttle valve which carries out closing motion control of the 2nd inhalation-of-air way have been arranged on the single throttle valve shaft which establishes the 1st inhalation-of-air way and the 2nd inhalation-of-air way in the throttle body, and crosses those inhalation-of-air ways The path of each inhalation-of-air way can be made into a minor diameter from the path of the conventional inhalation-of-air way constituted with a single inhalation-of-air way, and can reduce the load torque which acts on a throttle valve by this. And according to reduction of this load torque, it is what became possible [lowering the rated output of a motor], and while being able to miniaturize a motor, the consumed electric current can be saved.

[Brief Description of the Drawings]

[Drawing 1] Important section drawing of longitudinal section showing one example of

the inspired-air-volume control unit in the internal combustion engine which becomes this invention.

[Drawing 2]The diagram showing the relation of the throttle valve opening and load torque in 58mm o'clock of diameters of an inhalation-of-air way.

[Drawing 3]The diagram showing the relation of the throttle valve opening and load torque in 40mm o'clock of diameters of an inhalation-of-air way.

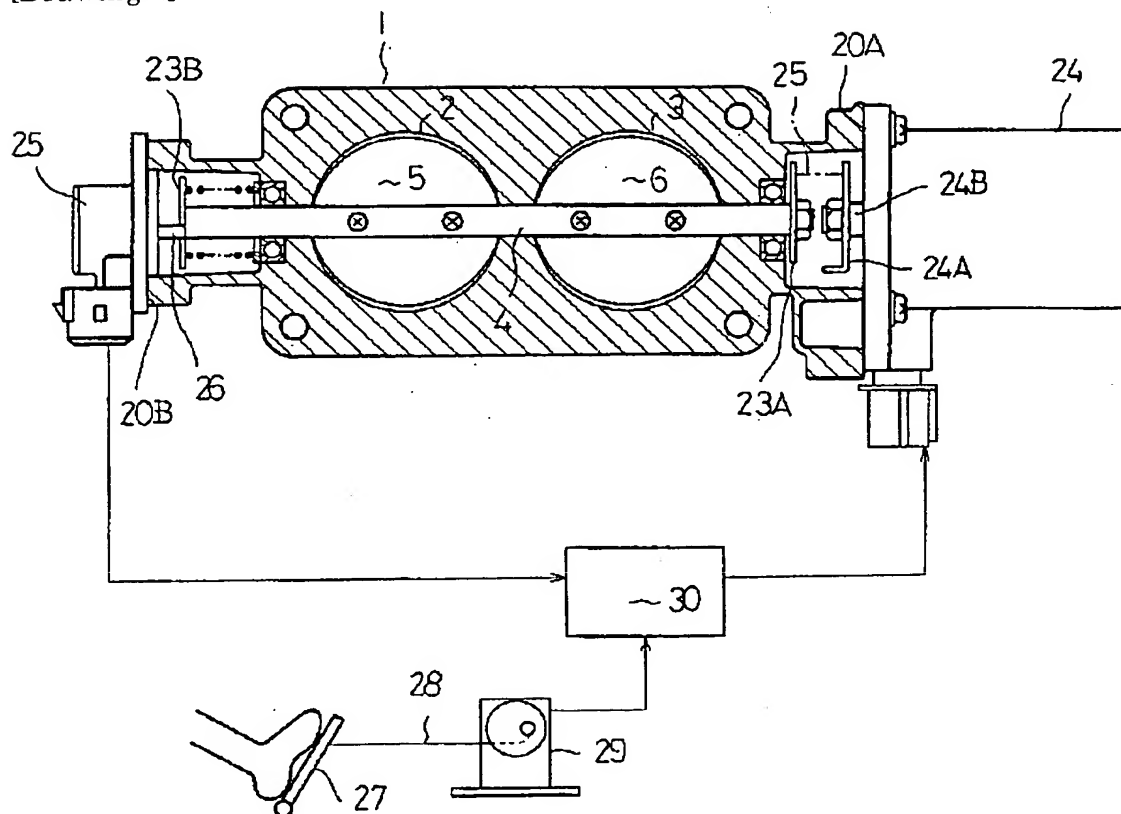
[Drawing 4]Important section drawing of longitudinal section showing the inspired-air-volume control unit in the conventional internal combustion engine.

[Drawing 5] The schematic diagram showing the condition of having built the inspired-air-volume control unit of drawing 4 into the internal combustion engine.

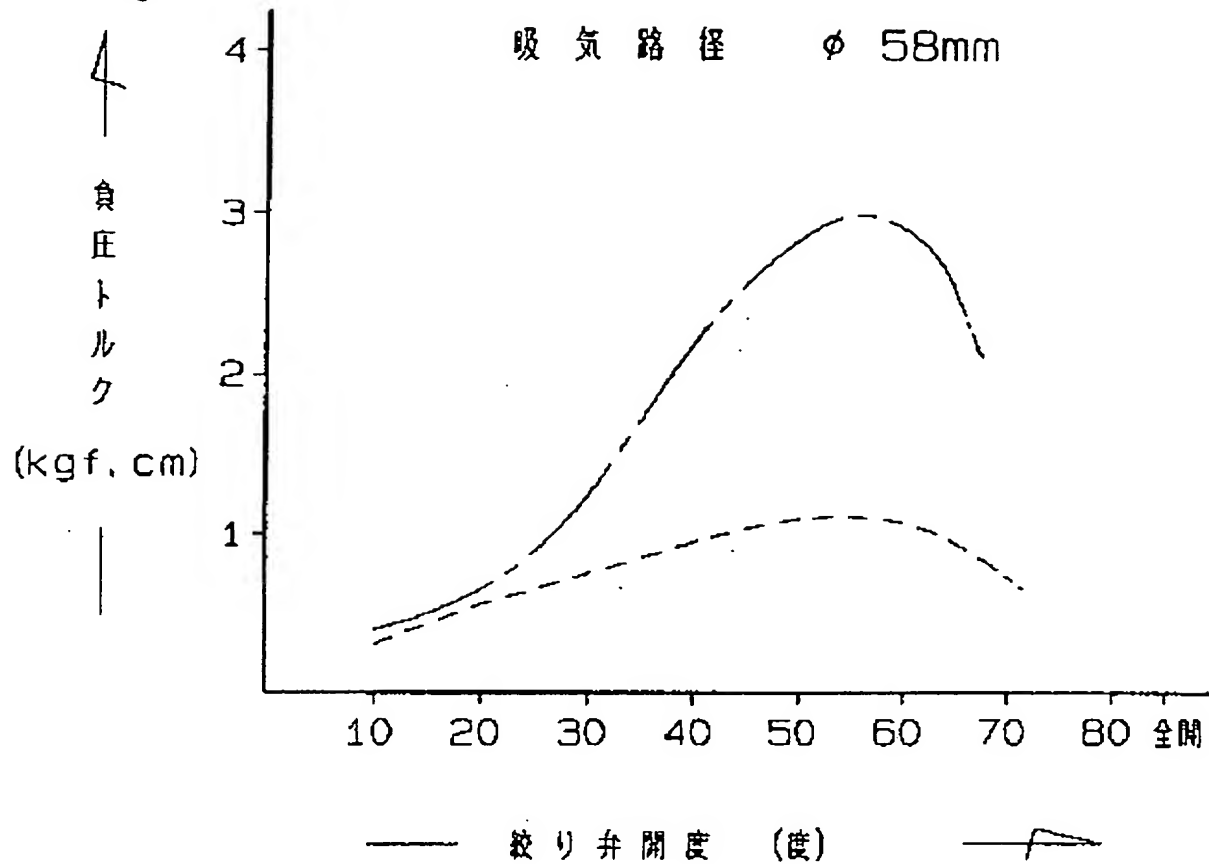
[Description of Notations]

- 1 Throttle Body
- 2 1st Inhalation-of-Air Way
- 3 2nd Inhalation-of-Air Way
- 4 Throttle Valve Shaft
- 5 1st Throttle Valve
- 6 2nd Throttle Valve
- 24 Motor
- 30 Electro Nick Control Unit

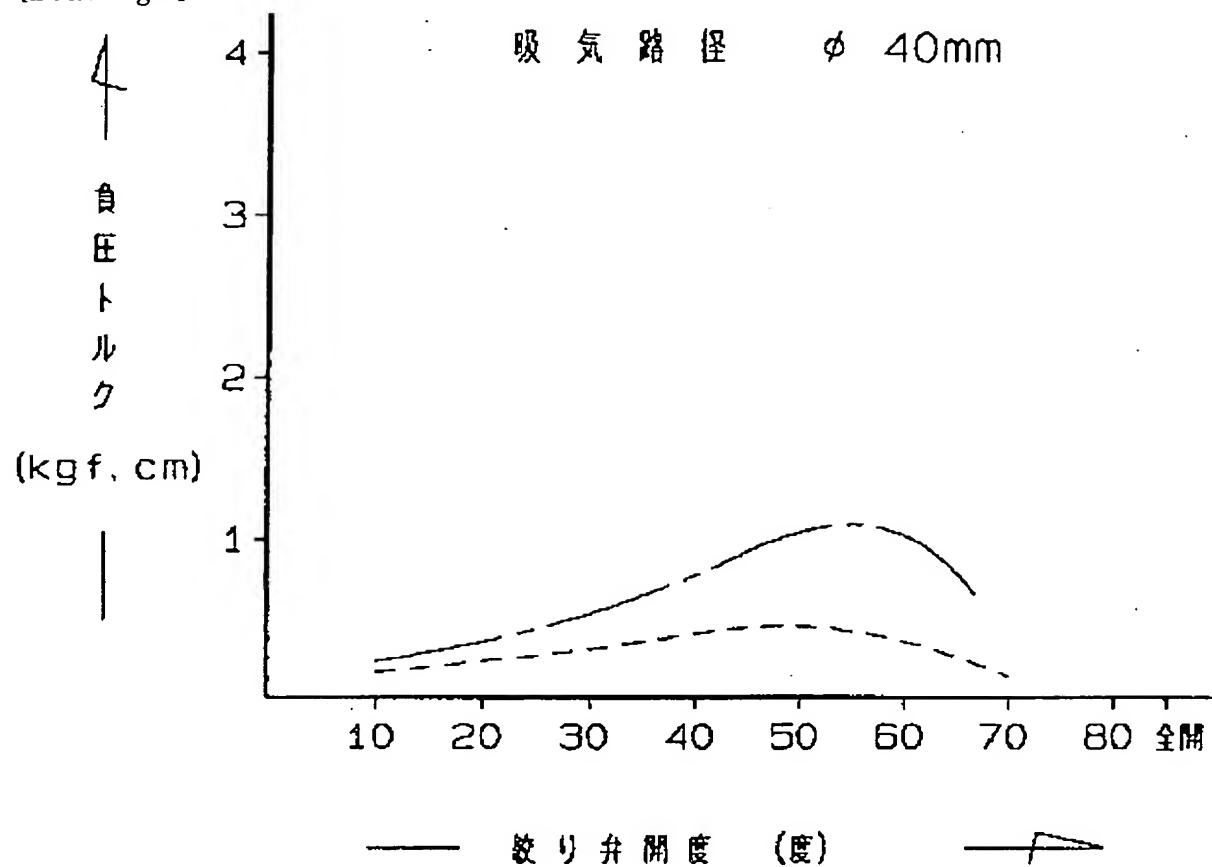
[Drawing 1]



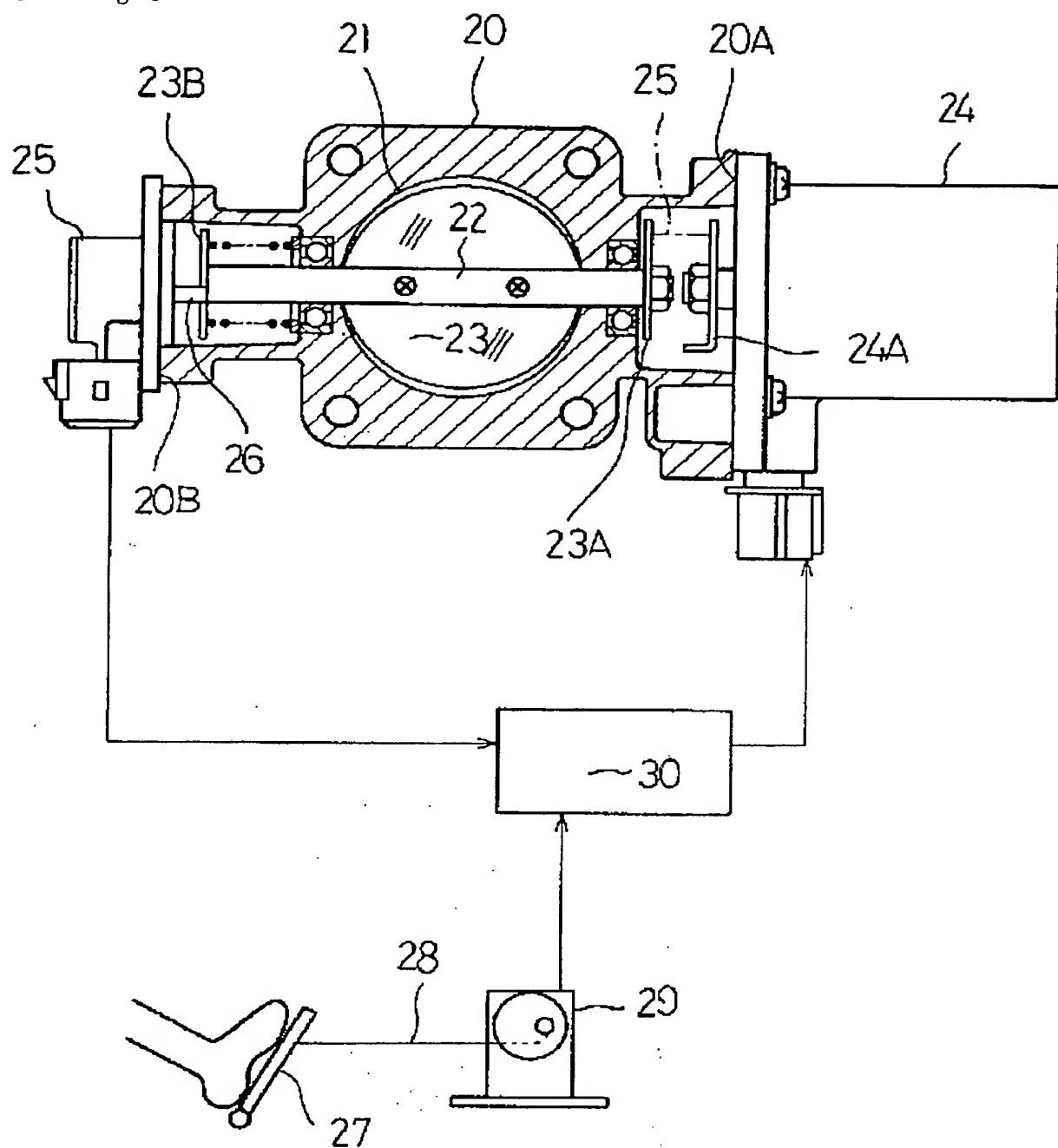
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 5]

